Section 12
Flight Crew Systems Overview

12.1 Introduction

The purpose of this section is to provide a broad, introductory overview of Flight Crew Systems (FCS) Subsystems and hardware.

As defined by the International Space Station (ISS) Program, FCS consists of the following categories of equipment:

- Restraints and Mobility Aids   Stowage

- Portable Emergency Provisions   Decals and Placards

- Housekeeping and Trash Management   Closeouts

- On-Orbit Maintenance   Crew Health Care System
  (CHeCS)

- Lighting

- Personal Hygiene   Operational and Personal
  Equipment

- Wardroom   Galley and Food System

- Crew Privacy   Inventory Management

This section covers all these categories with the exception of On-Orbit Maintenance (OOM), CHeCS, and Inventory Management, which are covered elsewhere.

This section is organized topically, by subsystem. The subsystems that are covered first (above the dashed line) include hardware that is present in both the U.S. and Russian segments. The latter subsystems are present only in the Russian segment prior to U.S. Hab module outfitting. The majority of discussions on hardware details covers the U.S.-provided hardware. In most cases, the Russian-provided hardware is functionally similar, although the details may differ. Some details on Russian hardware are discussed here, however, specific details on Russian hardware are provided by Russian-supplied training.

This section discusses the FCS hardware that is present up to and including Assembly Flight 8A, according to Revision C of the ISS Assembly Sequence.

12.2 Objectives

After completing this section, you should be able to:

- Identify FCS Subsystems and hardware.

- State the U.S. and Russian contributions of crew systems through Flight 8A.

- Describe the purpose of FCS hardware.

- Identify the interfaces FCS has with other ISS systems.

At the end of this section, there are ten questions students can use to check their understanding of the material.

12.3 Restraints and Mobility Aids

12.3.1 Purpose

Restraints and Mobility Aids (R&MAs) are provided to support Intravehicular Activity (IVA) personnel restraint, IVA equipment restraint, and IVA personnel mobility. R&MAs interface with the rack and module secondary structure for attachment points. R&MAs provide IVA body support without sacrificing crewmember maneuverability, and accommodate the human body's zero-g body posture and the inherent freedom associated with weightlessness. R&MAs are repositioned on orbit to meet changing workstation and translation requirements. R&MAs are located at frequently used workstations and translation paths. Portable R&MAs use a common attach mechanism (seat track), and are easily removed to allow for rack pivoting and to provide maximum aisle clearance.

12.3.2 Hardware Components

The hardware consists of numerous types of equipment restraints, personnel restraints, and mobility aids.

12.3.2.1 Equipment Restraints

Equipment restraints include tether straps, bungees, equipment bags, equipment anchors, cable ties, panel covers, Portable Computer System (PCS) desk, and Velcro. The tethers are cloth straps with carabiner hooks on each end. There are fixed length tethers, which are 14 inches long, and adjustable length tethers, which can extend up to 68 inches long. Figure 12-1 shows an adjustable tether.
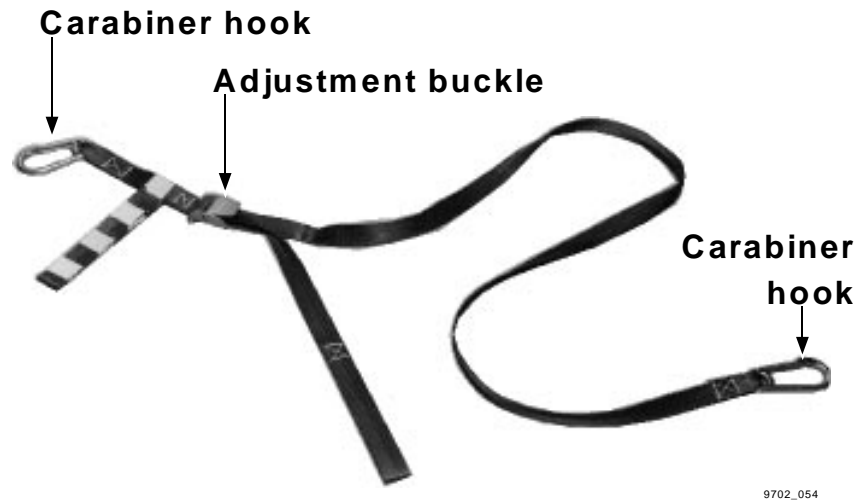
Carabiner hook

Adjustment buckle

Carabiner hook

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Figure 12-1. Adjustable tether

The bungees are elastic cords with carabiner hooks on each end. Several different lengths of bungees are provided. Figure 12-2 shows three types of bungees.
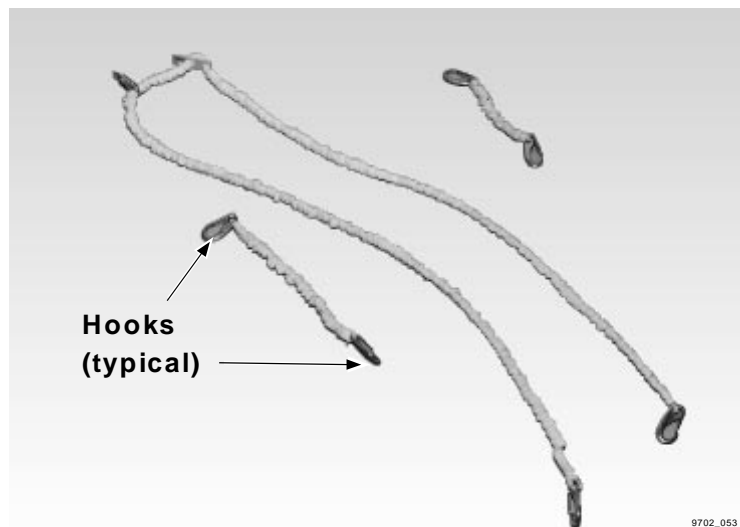

Hooks (typical)

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Figure 12-2. Bungees

Equipment bags are cloth bags provided to restrain loose equipment. The bags have several compartments and internal, moveable dividers to accommodate a variety of items. The cloth lids to the different compartments are mesh to facilitate viewing of the bag contents.

Although not formally part of the R&MA Subsystem, the seat track (Figure 12-3) is the primary mounting interface for R&MA hardware.
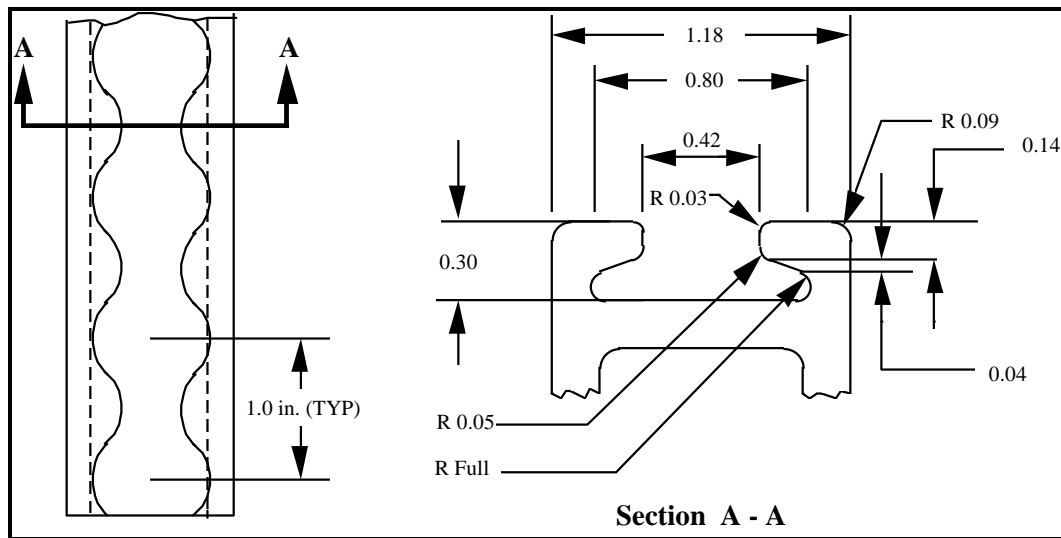
Figure 12-3. Seat track details

The seat track provides a common interface between the R&MA hardware and all U.S.-, European-, and Japanese-provided elements and racks. The seat track is part of the rack structure, and all racks have seat tracks mounted on their front face. Additionally, small sections of seat track ("seat track buttons") shown in Figure 12-4, are mounted on the standoff secondary structure to support maintenance activities in the standoff areas, and in other areas throughout the modules (see Figure 12-5). The seat track is extruded aluminum and is the passive half of the attachment interface.
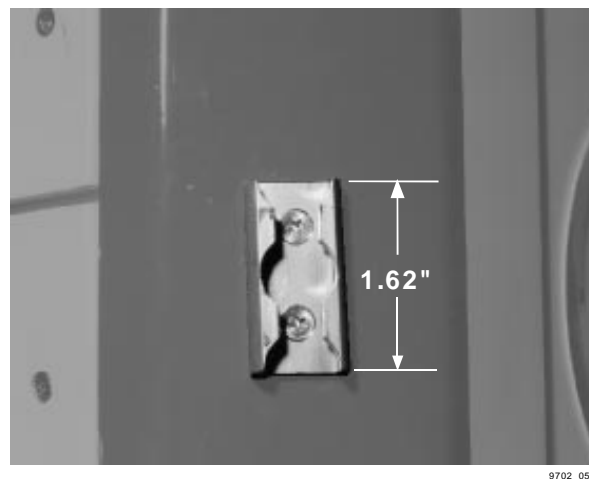

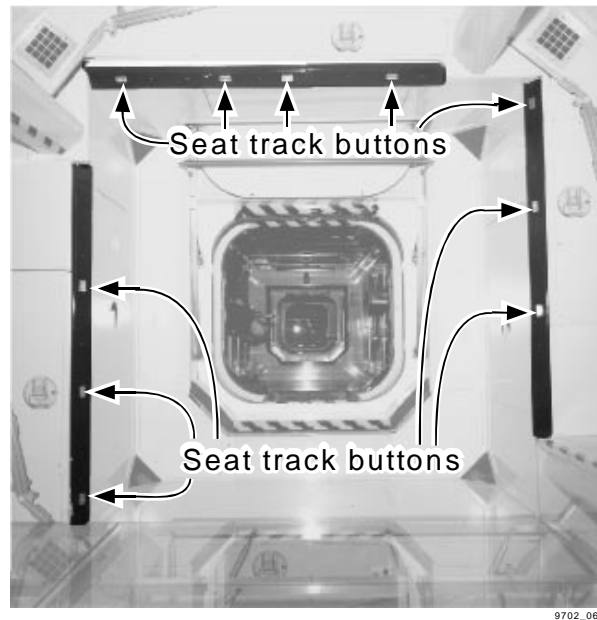**Figure 12-4. Short seat track button**

Figure 12-5. Node FWD endcone/alcove area

Anchors and attachments provide moveable secure anchors and attach points for restraining crew and equipment. This hardware includes Seat Track Equipment Anchors (STEA), Handrail Equipment Anchors (HEA), and Articulating Posts. Anchors and attachments are made from aluminum and attach to either the seat tracks or handrails.

As its name implies, the STEA is an equipment anchor that attaches to the seat track. The STEA has a tether ring, a hex stud socket, and a mechanism for attaching to the seat track (Figure 12-6). The tether ring is used as an anchoring point for tethers. The hex stud socket provides an anchor point for any hardware possessing a hex stud (Anchor Foot Restraint, Articulating Post, camera mounts, etc.).
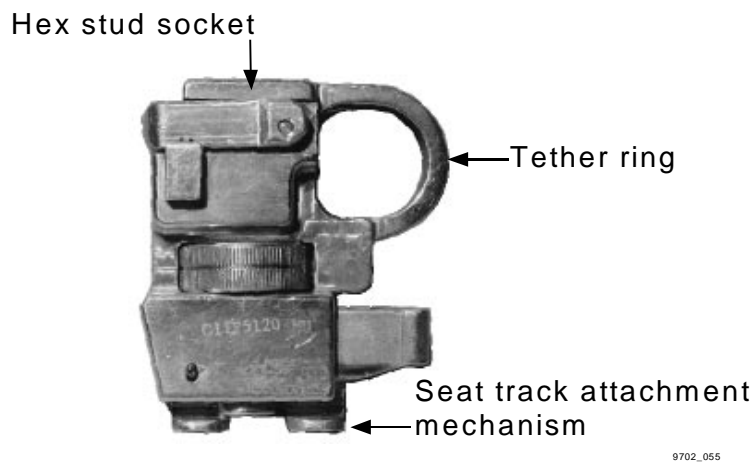

Figure 12-6. STEA attached to seat track

The HEA, like the STEA, is an equipment anchor containing a tether ring and hex stud socket (Figure 12-7).
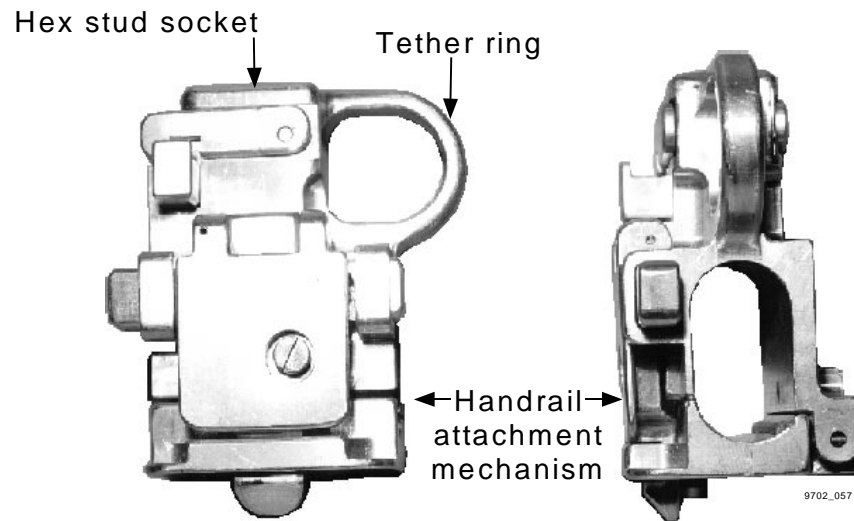

Figure 12-7. Handrail equipment anchor

Rather than connecting to a section of seat track, the HEA attaches to a handrail (Figure 12-8). The tether ring and hex stud socket of the HEA are identical to those on the STEA, and serve the same purposes.
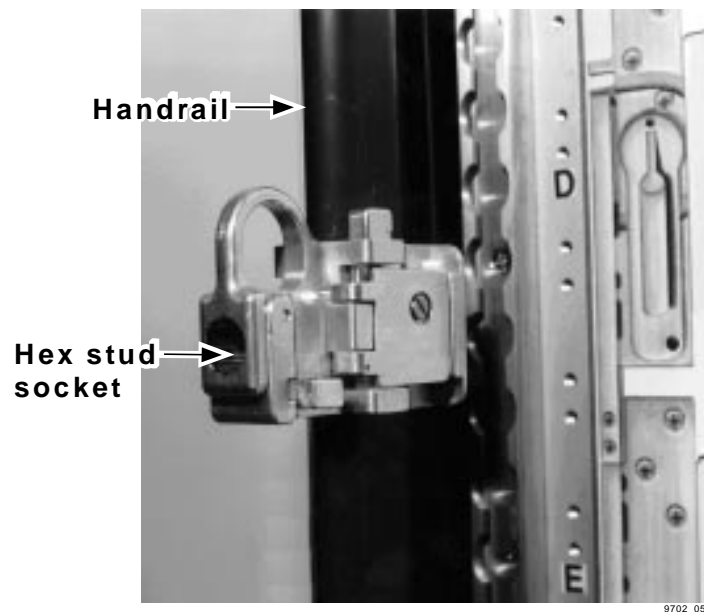

Figure 12-8. HEA attached to handrail

The Articulating Post provides equipment with a relatively fixed and stable structural anchor at any position or orientation which may be desired. The post includes two articulating joints, three post sections, a hex stud at one end (which interfaces with the STEA or HEA), and a socket at the other end which attaches to the equipment. Two or more posts may be used in series to increase the standoff distance from the anchor attachment or to increase the degree of articulation or orientation.

The PCS desk provides equipment with a stable mounting surface to a seat track. The desk top surface can be positioned according to the crewmembers' preference. A Cable Tie provides a means of securing cables to a seat track in order to keep the cables away from the working area.

Although not used as extensively as it is on the Shuttle, Velcro is used to restrain small items on ISS. Rack panel covers, which attach to seat track and cover a portion of a rack front, are provided to give the crew more surface area for restraining items. The panel covers have small pieces (typically 2 inches by 2 inches squares) of Velcro adhered to them.

12.3.2.2 Personnel Restraints

Personnel restraints consist of Long-Duration Foot Restraints (LDFRs), Short-Duration Foot Restraints (SDFRs), Anchor Foot Restraints (AFRs), Torso Restraints, and Long Duration Crew Restraints (LDCRs).

The LDFR (Figure 12-9) provides restraint for extended-length and/or heavy-duty tasks. The LDFR is mounted to the seat track on rack fronts. Its primary use is at workstation locations.
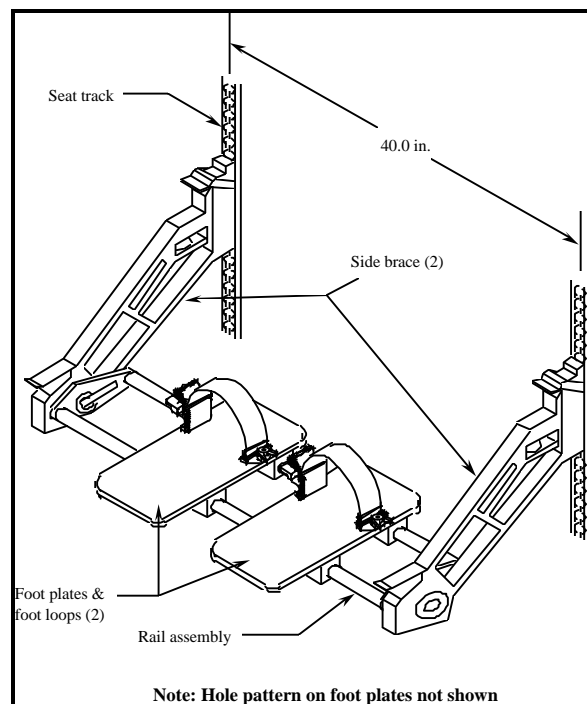

Figure 12-9. Long duration foot restraint

The SDFR, shown in Figure 12-10, supports short-duration tasks by providing features for easy ingress/egress while providing sufficient restraint to keep crewmembers from floating away from the work area. Each SDFR consists of a metal foot plate, cloth foot loop, and a clamp mechanism for attaching it to handrails. SDFRs are used in areas that do not require high force/torque applications or long periods of two-arm activity.
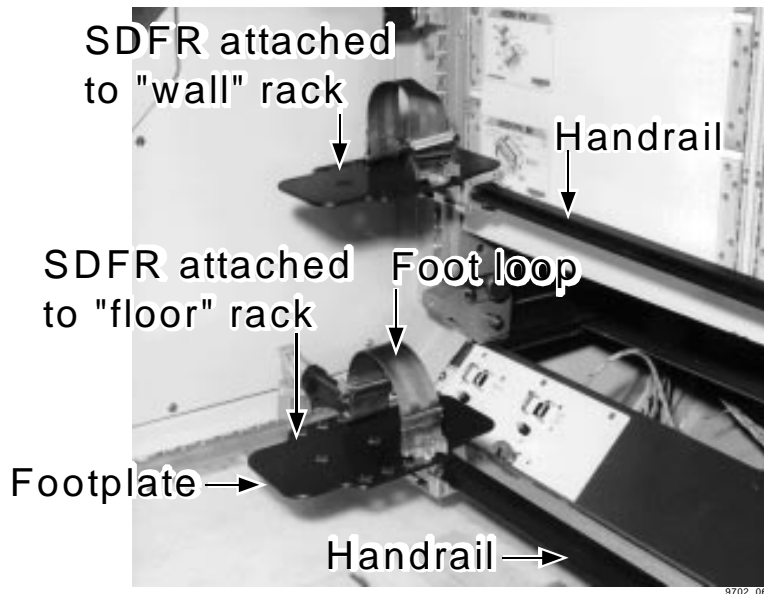

Figure 12-10. SDFR attached to handrails

Like the SDFR, the AFR supports short-duration tasks. The AFR consists of an aluminum foot plate similar to the foot plate of the SDFR. Rather than attaching directly to a handrail like the SDFR, the AFR uses a hex stud for attaching to the socket of the STEA or the HEA. This attachment scheme allows foot restraints to be located wherever a small section of seat track is available.

The torso restraint can be used in place of, or in addition to foot restraints to provide additional crew restraint. It is worn around the waist by the crewmember. The torso restraint can be used to restrain crewmembers performing maintenance tasks (which require high force/torque application) or robotics tasks (which require two hands and precise body positioning). The restraints have aluminum extension rods which have hex studs on the ends. The hex studs interface with the equipment anchors described above.

The LDCR is provided as an alternative to the LDFR. It attaches to the LDFR rail and consists of foam rollers and an arm. The restraint is used by placing the feet between 2 rollers and placing the other roller behind the knee.

12.3.2.3   Mobility Aids

Mobility aids (Figure 12-11) consist of removable handrails that allow the crew to move freely from one area to another. These handrails provide convenient handholds, attachment points for

various crew and equipment anchors and tethers, and mounting provisions for the SDFR. Handrails attach to rack fronts through the seat track interface. Three different length handrails are provided: 41.5 inches long, 21.5 inches long and 8.5 inches long. The 41.5-inch handrails are long enough to span the width of a rack, and can be mounted parallel or perpendicular to the seat track. The 21.5-inch handrails are provided for the primary translation paths, and in the areas around hatches. The 8.5-inch handrails are intended to be used on secondary translation paths, as portable mobility aids, and as equipment handles.

Figure 12-11. Handrails

The Rack Handle Assembly (RHA), shown in Figure 12-12, is provided as an equipment mobility aid to facilitate on-orbit rack translation. Two rack handles are used simultaneously on the top and bottom surfaces of the rack to provide for two-person rack translation. The RHA is attached to the rack via quarter-turn fasteners. The handle interface is located in line with the rack center of mass to aid in control of the rack. The RHA is stowed while not in use.
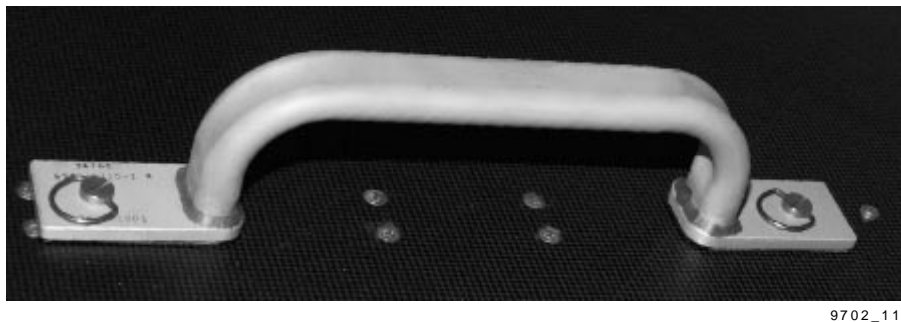

Figure 12-12. Rack handle assembly

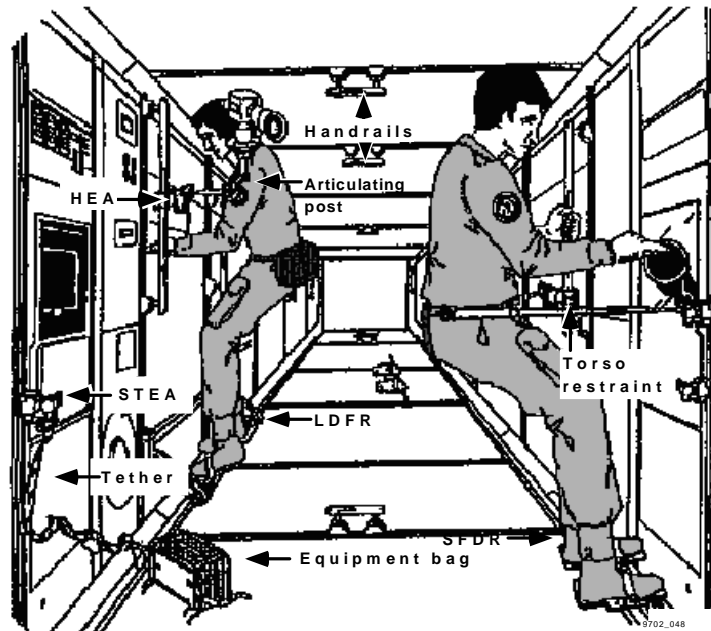Figure 12-13 shows the typical use of R&MA in a module.

Figure 12-13. Restraints and mobility aids use

12.3.3   Russian R&MAs

R&MAs in the Russian segment are different from those in the U.S. segment. Much of the equipment restraint is provided by bungees. These bungees are also used extensively for mobility aids. Foot bars run along the length of modules, near the floor, and are used by slipping the foot under the bar.

12.4 Stowage

12.4.1   Purpose

The Stowage Subsystem provides the packaging, containers and restraints for all loose crew and payload/user equipment, supplies and consumables, trash, and hardware replacement units stowed within the Space Station elements.

12.4.2   Hardware Components

The Stowage hardware consists of stowage racks, stowage lockers, stowage trays, Aisle Stowage Containers (ASCs), Resupply Stowage Platforms (RSPs), and soft stowage bags. Stowage racks (Figure 12-14) consist of a rack structure, a stowage locker structure and stowage trays.

Stowage Rack
(locker doors not shown)

Rack
structure

Locker
structure
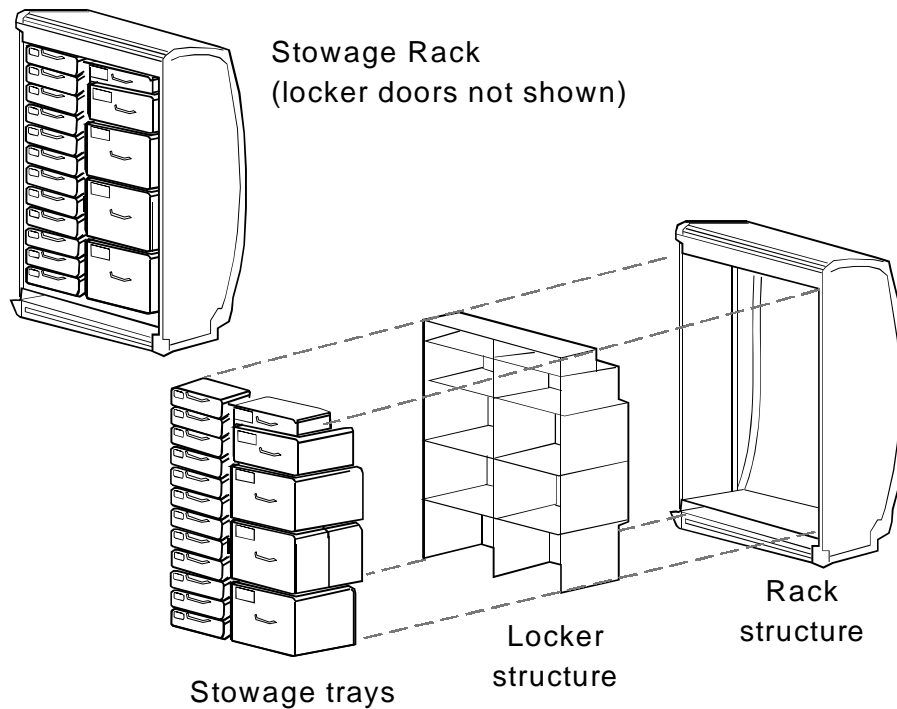
Stowage trays

Note: Locker doors not shown.

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Figure 12-14. Stowage rack

The stowage tray is the main "module" for stowing items. The trays vary in length and height (all are roughly 17.5 inches wide). A single high tray is 5.25 inches tall, a double is 10.5 inches, and a triple tray is 15.75 inches. The different lengths are 10 inches, 17 inches, 30 inches, and 34 inches. Through different combinations of height and length, a variety of sizes of trays are provided to accommodate many different stowage configurations. The locker structure transfers the launch and landing loads to the rack structure (rather than having the trays take the loads). Like the trays, the lockers have different heights and lengths. The sizes are such that a triple high, 34-inch long locker can accommodate different combinations of trays: a triple-high, 34-inch long tray; or 3 single-high, 34-inch long trays; or 1 double-high, 34-inch long tray and 1 single-high, 34-inch long tray; or 6 single-high, 17-inch long trays; etc.

Other hardware used for stowage are Resupply Stowage Platforms (RSPs), Aisle Stowage Containers (ASC) and ASC softpack stowage bags. The RSPs are metal structures that attach to the Mini-Pressurized Logistics Module (MPLM) rack attach points and carry soft stowage bag. The ASCs are metal structures that attach to the front of stowage racks in the MPLM. Both the RSPs and ASCs have attach points for mounting ASC softpack stowage bags and oversized items that cannot be accommodated in stowage trays. The ASC softpack bags are 38.5 inches by 19 inches by 17.8 inches, and can accommodate the volume of seven single high, 17-inch long stowage trays. The RSP can accommodate the ASC softpack and shuttle soft stowage bags (i.e., airlock stowage bags, which are 47 inches by 21 inches by 34 inches). The RSPs and ASCs are intended for use during logistics flights only, and are not permanently used on orbit.

12.4.3　　Russian Stowage

Some stowage in the Russian modules is provided behind panels along the walls, with the panels being secured with screws, or in some modules, the panels are hinged doors. Some specialized stowage areas are designed to conform to stowed items and there is some standardized stowage for food and clothes. Much of the stowage in the Russian segment is in the Docking and Stowage Module.

12.5　Portable Emergency Provisions

12.5.1　　Purpose

The Portable Emergency Provisions (PEPs) Subsystem provides hardware to ensure crew survival in the event of any single failure, including the complete loss of any one pressurized element.

12.5.2　　Hardware Components

The PEPs subsystem is comprised of Missed Resupply Provisions and Portable Breathing Apparatuses (PBAs). Note that Portable Fire Extinguishers (PFEs) also support the function of crew survival, but are part of the Environmental Control and Life Support System (ECLSS) Fire Detection and Suppression (FDS) system. See the ECLSS section for a discussion of the U.S. PFE.

Additional food, waste and trash management supplies, personal hygiene supplies and clothing are stowed on orbit as "Missed Resupply Provisions." These provisions can support the crew 45 days past the nominal mission duration. Missed resupply provisions are located strategically so as not to occupy high-traffic stowage volumes. Also, the missed resupply provisions are distributed throughout the Station modules to minimize the impact of the loss of any one module. The missed resupply provisions food items require water and interface with the onboard water system. The total weight of assembly complete missed resupply provisions is approximately 1077 lbs, and the total volume is approximately 90 cubic feet.

In addition to the missed resupply provisions, PEPs also provides a PBA (Figure 12-15) which sustains the crew in an emergency such as fire, environmental contamination, or module depressurization.
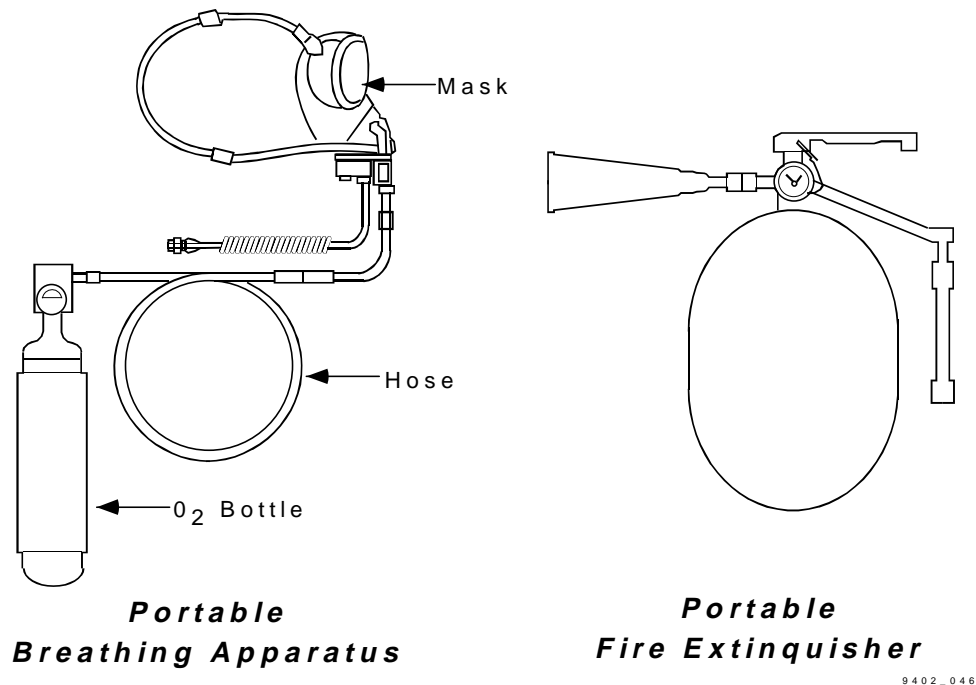
*Portable
Breathing Apparatus*

*Portable
Fire Extinquisher*

9 4 0 2 _ 0 4 6

Figure 12-15. Portable emergency provisions

The PBA protects the wearer's face and eyes, and provides 15 minutes of 100 per cent breathing Oxygen (O_2) at a flow rate of 18 liters per minute (the PBA can support a maximum flow rate of 90 liters per minute). The PBAs may be connected to the Station ECLSS O_2 distribution system and used for contamination clean-up tasks which take longer than 15 minutes.

The PBA consists of a portable O_2 bottle assembly, a Quick Don Mask (QDM) and connecting hose, and an extension hose and tee. A microphone and earphone are built into the mask, and the PBA interfaces with the Internal Audio System so the crewmembers can maintain communication with each other and the ground during emergencies requiring a PBA.

12.5.3   Russian PEPs

Russian Segment PEPs consist of breathing masks and fire extinguishers. The masks provide O_2 from a solid source and can last several hours. The O_2 is provided by a chemical reaction with the crewmember's exhaled air. The fire extinguishers use an aqueous foam (mostly water, and some foaming agent) propelled by gaseous nitrogen.

12.6 Decals and Placards

12.6.1   Purpose

Decals and placards are provided throughout the modules to display crew instructions, procedures, and location coding nomenclature.

12.6.2   Hardware Components

Decals and placards are used for displaying identification information, operating instructions, location coding information, and stowage labeling. Racks, stowage trays and their contents are identified and labeled, as are individual parts, to assist in inventory control. Failed and expended items are also labeled.

Trays are labeled with stowage tray cards (Figure 12-16), which include a listing of the contents of the tray, a graphical representation of the tray configuration, and its stowage location. The card is folded and therefore has four surfaces (inside top and bottom, and outside top and bottom) on which different stowage configurations and locations can be represented.
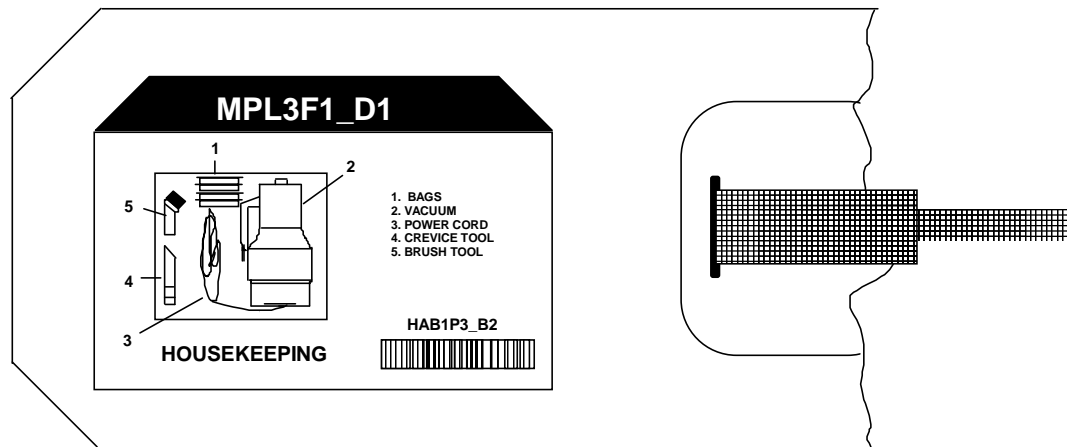
Figure 12-16. Stowage tray card

Instructional, procedural, and safety information can be relayed via decals applied to equipment. Figure 12-17 shows decals that are on the common hatches. These decals provide the crew with information pertinent to hatch operations.
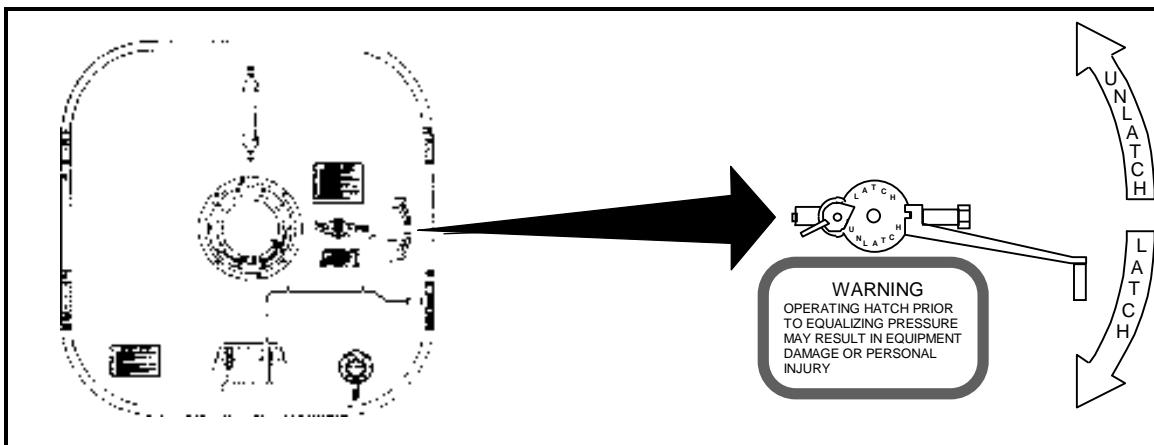
Figure 12-17. Hatch decal

All labeling normally visible to the crew is required to be in English (including those in the Russian Segment). A secondary language is permissible. However, the secondary language must be at least 25per cent smaller than the English label and cannot obstruct the English label.

12.7 Housekeeping and Trash Management

12.7.1   Purpose

Housekeeping and Trash Management equipment and supplies are provided to facilitate routine cleaning and trash management (any payload or experiment that uses reactive or hazardous materials must provide clean-up and/or isolation equipment and supplies).

12.7.2   Hardware Components

The hardware consists of a portable wet/dry vacuum cleaner (Figure 12-18) and attachments, wipes, cleansers, and trash collection bags and bag liners.

The wet/dry vacuum cleaner is powered by the 120 V dc utility outlet ports (part of the Electrical Power System (EPS)), and provides for collection of loose, wet or dry debris and fluids. The vacuum cleaner can be used for cleaning ECLSS filters, removal of free-floating fluids, and collecting debris. Various attachments are provided to accommodate a variety of cleaning tasks. Disposable vacuum bags are also provided.
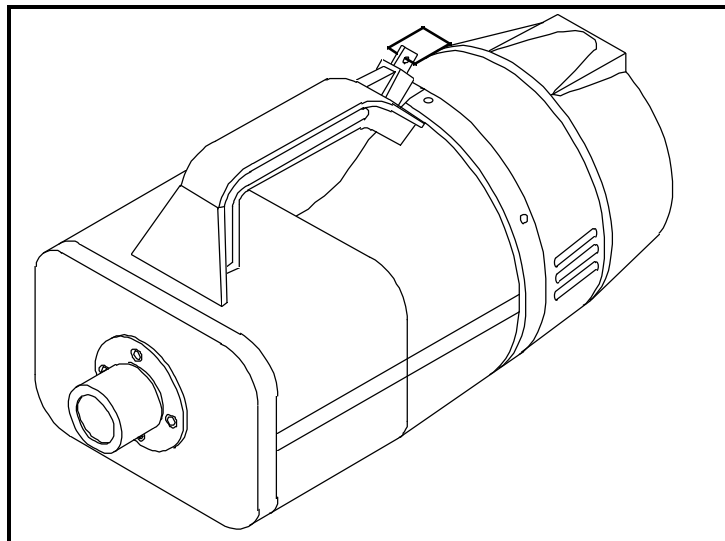

Figure 12-18. Wet/dry vacuum cleaner

Six different types of wipes are provided for housekeeping: dry wipes (paper wipes), durable wipes (dry fabric), detergent wipes (paper impregnated with a mild detergent), disinfectant wipes (paper wipes impregnated with a disinfectant), utensil detergent wipes, and utensil sanitizing

wipes. The wipes are packaged in cartridges, which are loaded into a dispenser. The dispenser has a sealing lid to minimize evaporation of the impregnated material.

Detergent pouches are also provided to contain and dispense detergents, surfactants, or disinfecting agents.

Portable trash bags are located throughout the modules via the seat track. The bags are easily removable and are lined with bag liners. Once the liners are full of trash, they are closed and stowed for eventual disposal.

12.7.3   Russian Housekeeping Supplies

The Russian segment is provided with a vacuum cleaner and wipes similar to those on the U.S. segment.

Trash (including used clothing and linens) in the Russian segment is collected and stowed in empty food containers and special sealable bags. These are then disposed of in the Progress vehicle.

12.8 Closeouts

12.8.1   Purpose

Closeout panels and seals are provided to segregate internal volumes for light, noise, and particulate control and for aesthetic value.

12.8.2   Hardware Components

The closeouts hardware (Figure 12-19) includes closeouts associated with racks (rack seals, standoff closeouts, utility interface panel closeouts), rack volume closeouts, endcone closeouts, Common Berthing Mechanism (CBM) vestibule closeouts, and window shades.
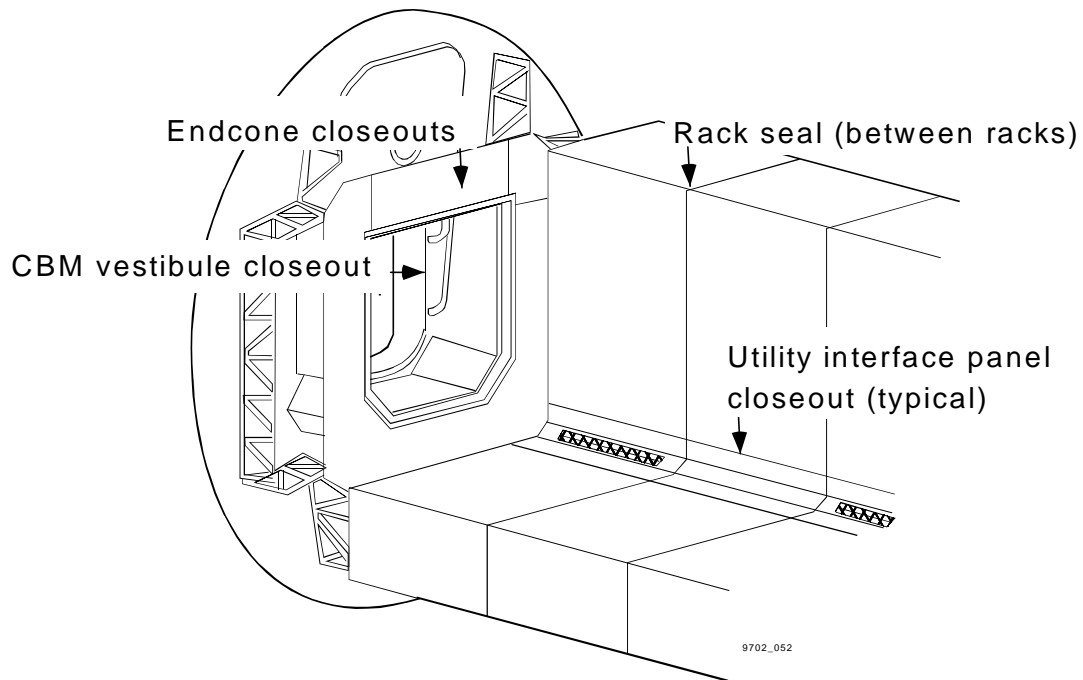
Figure 12-19. Closeout panels (typical)

12.9 Lighting

12.9.1   Purpose

Lighting equipment is provided to facilitate productivity.

12.9.2   Hardware Components

Lighting equipment consists of general lighting, portable utility lighting, and emergency egress lighting. All the lighting hardware components interface with the EPS for power.

The general lighting is provided by General Luminaire Assemblies (GLAs) (Figure 12-20) located in the modules. There are 12 GLAs in the Lab, and 8 in Node 1.

Figure 12-20. General luminaire assembly

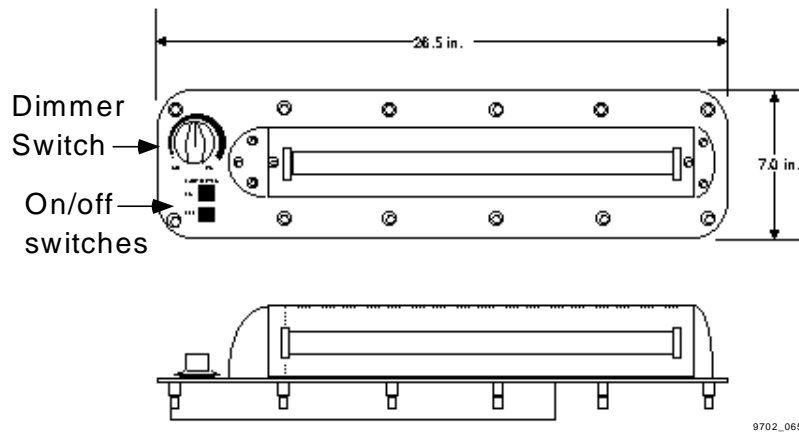The Portable Utility Light (PUL) provides supplemental lighting as needed. For example, during a maintenance activity behind a rack, a PUL can be mounted (using the equipment anchors described in 12.3.2.1) to provide more illumination in the area.

Emergency Egress Lights (EELs) are mounted in the module endcones to identify the egress path to the escape vehicle. The lights are strips of Light Emitting Diodes (LEDs) which are powered by batteries. The batteries are constantly charged, and the lights turn on only if there is a total loss of power to module.

For more information on the Lighting System, refer to JSC-36284, Lighting C 21002.

12.10 Personal Hygiene

12.10.1 Purpose

Personal Hygiene equipment and supplies are provided to facilitate personal hygiene and metabolic waste collection.

12.10.2 Hardware Components

The Service Module (SM) contains a waste collection compartment and hygiene supplies (washcloths, soap, shampoo, razors, toothbrushes, toothpaste, etc.).

The waste collection compartment contains a commode/urinal which is used to collect urine and fecal matter.

Personal hygiene (bathing, shaving, oral hygiene, etc.) is also accommodated in the SM.

The personal hygiene equipment requires electrical power, and has an interface to the onboard water processing system.

12.11 Operational and Personal Equipment

12.11.1 Purpose

Operational and Personal Equipment (O&PE) is used to accomplish routine daily activities (both regular-duty and off-duty activities) in operating the Station.

12.11.2 Hardware Components

The O&PE hardware includes clothing, cameras, calculators, pens and pencils, recreational equipment (books, tapes, CDs, tape players, CD players, games), and a battery charger. Much of the recreational equipment is standard, off-the-shelf equipment, and runs off of rechargeable batteries (hence the battery charger). Some of the O&PE hardware requires power from the EPS.

Current agreements state that NASA provides O&PE and personal hygiene supplies for astronauts, and the Russian Space Agency (RSA) provides supplies for cosmonauts. However, the International Space Station Program Office (ISSPO) is working toward commonality agreements.

12.12 Wardroom and Galley and Food System

12.12.1 Purpose

The Wardroom and Galley and Food systems provide nutritional support for the crew.

12.12.2 Hardware Components

The hardware includes wardroom area, food, food preparation hardware (food warmers, food trays, utensils, etc.). The wardroom table/galley is located in the SM, and provides an area for preparing and consuming meals. The table includes crew and equipment restraints, and has recessed wells for food warming. The wardroom area also includes a potable water dispenser, which dispenses hot and ambient water for drink and food hydration, a trash container, and two refrigerators. The Wardroom/Galley requires electrical power and water.

Most of the Russian food is ambient stowed (freeze-dried, low moisture, or thermostabilized) and prepackaged in individual serving packages. Also, fresh foods are supplied to provide variety and prevent food boredom. This includes in-season products such as apples, lemons, oranges, tomatoes, onions, garlic, and kielbasa.

The U.S. food (prior to assembly complete) is based on the shuttle food system. Six types of food (thermostabilized, rehydratable, intermediate moisture, natural form, fresh, and irradiated) and beverages are provided. The food is packaged to be compatible with the SM wardroom table/galley.

Current agreements state that NASA provides half the food and RSA provides half - regardless of crew make-up.

12-19

Food preparation and consumption supplies include meal trays (for restraining food packages and utensils), knives, forks, spoons, scissors (for opening food packages), straws, and condiments.

12.13 Crew Privacy Accommodations

12.13.1 Purpose

Crew Privacy Accommodations (Crew Quarters) provide the crewmembers with a private area for sleeping, changing clothes, and off-duty activities.

12.13.2 Hardware Components

The hardware includes crew quarters (includes a private place to sleep, change clothes, "personal retreat", a place to hang personal pictures, store clothes, etc.), and sleep restraints. The staterooms require electrical power and conditioned air. Currently, the SM design includes two crew quarters ("staterooms"). However, NASA is working to get a third stateroom added.

12.14 Summary

Interfaces Summary			
	ECLSS	EPS	C&T
Portable Emergency Provisions	H2O, O2		Audio
Housekeeping and Trash Management		Power	
Lighting		Power	
Personal Hygiene	water	Power	
Operational and Personal Equipment		Power	
Wardroom, Galley and Food	water	Power	
Crew Quarters	conditioned air	Power	

Restraints and Mobility Aids

- Hardware: equipment restraints, crew restraints, and mobility aids.

- Purpose: support IVA personnel and equipment restraint and personnel mobility.

Stowage

- Hardware: stowage racks, lockers, trays, containers.

- Purpose: stow loose equipment, supplies, and consumables.

Portable Emergency Provisions

- Hardware: PBA, missed resupply provisions.

- Purpose: sustain the crew in the event of an emergency and ensure the survival of the crew if a pressurized element is lost.

Decals and Placards

- Hardware: cue cards, stowage tray cards, and decals.

- Purpose: display crew instructions, procedures, and location coding nomenclature.

Housekeeping and Trash Management

- Hardware: vacuum cleaner and attachments, wipes and cleansers, trash collection bags.

Purpose: facilitate routine cleaning and trash management.

Closeouts

- Hardware: rack seals, standoff closeouts, utility interface panel closeouts, rack volume closeouts, endcone closeouts, window shades.

- Purpose: segregate volumes for noise and particulate control, and for aesthetic value.

Lighting

- Hardware: general lighting, portable utility lights, and emergency egress lighting.

- Purpose: facilitate productivity.

Personal Hygiene

- Hardware: waste management compartment, and hygiene supplies.

- Purpose: support personal hygiene and metabolic waste collection.

Operational and Personal Equipment

- Hardware: clothing, cameras, calculators, pens and pencils, recreational equipment, battery charger.

- Purpose: facilitate routine daily activities.

Wardroom and Galley and Food System

- Hardware: food and food preparation hardware, ovens, food trays.

- Purpose: provide nutritional support for the crew.

Crew Privacy

- Hardware: crew quarters.

- Purpose: provide a private area for sleeping, changing of clothes, and off-duty activities.

Questions

1. Which of the following is <u>not</u> a subsystem of Crew Systems?

    a. Decals and Placards

    b. On-orbit Maintenance

    c. Closeouts

    d. Internal Audio System

    e. All of the above are Crew Systems subsystems.

2. Which of the following is <u>not</u> a subsystem of Crew Systems?

    a. Restraints and Mobility Aids

    b. Operational and Personal Equipment

    c. Water Recovery and Management

    d. Portable Emergency Provisions

    e. All of the above are Crew Systems subsystems.

3. Which of the following statements is (are) true?

    a. Stowage hardware tracks on-board supplies.

    b. Portable Emergency Provisions are used to sustain the crew in the event of an emergency.

    c. O&PE is provided to repair powered equipment.

    d. The wardroom is used for conducting Life Science experiments.

    e. All of the above.

4. Which of the following statements is (are) true?

    a. Restraints and Mobility Aids are used to support crew translation.

    b. Personal Hygiene hardware is used to clean the interior of the station.

    c. Crew Privacy Provisions are used to support classified experiments.

    d. Housekeeping and Trash Management hardware is used to dispose of crew metabolic waste.

    e. All of the above.

5. Which of the following does <u>not</u> interface with the Galley/Food Subsystem?

    a.   EPS

    b.   ECLSS

    c.   C&T (Communications and Tracking)

6. Which of the following subsystems interfaces with the on-board Water Systems?

    a. Restraints and Mobility Aids

    b. Personal hygiene

    c. Lighting

7. **Fill in the blank:** The _____ subsystem includes items that display location coding information, crew procedures, warning labels, and stowage information.

8. **Fill in the blank:** The _____ subsystem supports the nutritional needs of the crew.

9. Match the hardware subsystems with their components (use each component only once, there will be two left over).

1. Restraints and Mobility Aids Subsystem	a) Meal preparation utensils
2. Portable Emergency Provisions Subsystem	b) Compact disk player
3. Housekeeping & Trash Management Subsystem	c) Biocide wipes
4. Lighting Subsystem	d) PBA
5. Operational & Personal Equipment Subsystem	e) Task light assembly
6. Galley and Food Subsystem	f) First aid kit
	g) Shampoo
	h) Equipment bag

10. Match the hardware subsystems with their components (use each component only once, there will be two left over).

1. Stowage Subsystem
2. Decals and Placards Subsystem
3. Closeouts Subsystem
4. Personal Hygiene Subsystem
5. Wardroom Subsystem
6. Crew Privacy

a) Rack volume closeout
b) Stowage tray
c) Dining table
d) Wet/dry vacuum cleaner
e) Utility outlet panel
f) Waste collection compartment
g) Stateroom
h) Warning labels